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RECORD OF REVISIONS

Rev	Date	Description	POC	OIC
0	05/22/02	Initial issue.	Tobin H. Oruch, *FWO-SEM*	Kurt Beckman, *FWO-SEM*

1.0 GENERAL

This document is designed to provide a standard document format and style guide for use in developing the LANL Engineering Manual (LEM) as required by LIR220-03-01, "LANL Engineering Manual," and Chapter 1 of that manual.

The format and examples of the type of technical content that should be adhered to by LEM personnel in the development of assigned EM chapters is defined below.

Guidance on how to develop each section of a LEM chapter is provided in italics. Examples are provided within each section after the guidance. Examples appear just as they would in an actual chapter (i.e., font, paragraph numbering, style, etc.).

The ultimate writer's guidance is embodied in the LEM itself; i.e., the most recently produced LEM sections will always serve as the best examples of format and content. Where this Guide and those sections conflict, consult with the Standards Manager for clarification.

***Note**: LEM content is intended to supplement the requirements from national codes and standards, local codes, and federal and state regulations. Requirements should be developed only for:*

- *Subject matter that is not contained in national codes and standards,*
- *Unique site requirements relative to existing national codes and standards,*
- *Justifiable unique site application or configuration.*

2.0 CHAPTER FORMAT

2.1 Sections

Chapters will be assigned for all subject matter to be covered by the Engineering Manual. The sections of the discipline chapters should be as follows:

i. *Table of Contents*

ii. *Records of Revision*

100 *General (optional, phasing out)*

200 *Engineering Requirements/Guidance*

300 *Drawings*

NOTE: The above is not applicable to Chapter 1.

2.2 Section Headings

1.0 FIRST HEADINGS

The first level headings are 14 pt. Times New Roman, small caps (initial letters are

capitalized) and bold, on left margin, level heading indented at 0.5. Body text (11 pt.) begins on the second line under the number and aligned with title.

1.1 Second Level Headings

The second level heading is 12 pt. Times New Roman; initial letters are capitalized and bold, on left margin, level heading indented at 0.5. Body text (11 pt.) begins on the second line under the number and indented as title at 0.5. **NOTE:** Headings for the second level are optional.

1.1.1 Third Level Headings

The third level heading and/or text is 11 pt. Times New Roman, initial letters are capitalized and bold. If outline numbering is used align on left margin, text indented 0.5. This level is typically numbered beginning with "**A**" - left alignment at 0.5, text indented at 0.75. **NOTE:** Headings for the third level are optional.

2.3 Italicized Text

Use 11 pt. italicized text to identify recommendations and guidance. Preface the material with the word "guidance" wherever possible. Employ the words "should" or "recommended" rather than shall in guidance statements.

Example

A. Polymeric seals shall not be used in radiological service where failure is unacceptable and either of the following apply:

- radiation exposure rates cannot be predicted or
- seal replacement cannot be performed regularly and cost-effectively

Guidance: In these instances, metal seals are recommended. Metal seals are also preferable where outgassing or leakage is detrimental, such as in radioactive or toxic gas and high vacuum systems.

2.4 Tables

Tables text shall be Arial 10 pt. Table identification is the section numbering and a sequential number (e.g., D30GEN-1).

2.5 Content description

2.5.1 Section 100

Use of this section is being eliminated but can be used if desired.

2.5.2 Section 200 – Engineering Requirements/Guides

Each chapter's Section 200 should be organized using UNIFORMAT II as shown in ASTM E1557 or CSI publications. Include the following sections and content:

- *Include facility- and project-generic requirements in this section (etc. would cover specific topics such as Electrical Demolition, Raceway Systems, etc.).*

- *List all national consensus codes and standards to be followed (by organization/number and title). Do not use words such as "are called to the attention of the reader" in this context.*
- *Every EM standard detail in Section 300, Installation Drawings, should be referenced by the General Requirements section of the EM.*
- *Every Construction Spec should be referenced by the General Requirements section of the LEM* chapter(s) that relate to its contents.

Example:

217.2.1 For general use provide 20 amp, 120-277 volt quiet switched. Refer to LANL Facility Construction Specifications Section 16140, *Wiring Devices.*

Following is guidance on writing good requirements (adapted from Ref. 5):

*A good requirement states something that is **necessary**, **verifiable**, **attainable,** and **clear**. Even if it is verifiable and attainable, and eloquently written, if it is not necessary, it is not a good requirement. To be verifiable, the requirement must state something that can be verified by examination, analysis, test, or demonstration. Statements that are subjective, or that contain subjective words, such as "easy," are not verifiable. If a requirement is not attainable, there is little point in writing it. A good requirement should be clearly stated.*

Need *If there is a doubt about the necessity of a requirement, then ask: "What is the worst thing that could happen if this requirement were not included?" If you do not find an answer of any consequence, then you probably do not need the requirement.*

Verification. *As you write a requirement, determine how you will verify it. Determine the criteria for acceptance. This step will help insure that the requirement is verifiable.*

Attainable. *To be attainable, the requirement must be technically feasible and fit within budget, schedule, and other constraints. If you are uncertain about whether a requirement is technically feasible, then you will need to conduct the research or studies to determine its feasibility. If still uncertain, then you may need to state what you want as a goal, not as a requirement. Even if a requirement is technically feasible, it may not be attainable due to budget, schedule, or other, e.g., weight, constraints. There is no point in writing a requirement for something you cannot afford -- be reasonable.*

Clarity. *Each requirement should express a single thought, be concise, and simple. It is important that the requirement is not misunderstood -- it must be unambiguous. Simple sentences will most often suffice for a good requirement.*

2.5.3 Section 300 -- Drawings

301 LIST OF DRAWINGS

Example:

Dwg. No.	Rev. No.	Title
ST7001	2	Legend and General Notes

Following the listing, insert all appropriate installation drawings. These are designated with the "ST" series, with sequential numbers maintained by the EM Standards Manager and FWO Configuration Management. The number series corresponds with the chapter number (e.g, ST6105 is in Chapter 6, Mechanical).

Drawings should be webposted both in native (AutoCad) and pdf formats. A title block that accommodates Eng Manual particulars is used. Drawings should generally be produced as "B" size (11x17), using multiple sheets as necessary, per the Drafting Manual standards. [B size, when reduced 50% for an "A" sized (8.5 x11) pdf-format drawing for web-posting/printing for manuals, is still very legible]. Originals other than "B" size are allowable when this is more convenient than multiple sheets.

3.0 BASES

The basis for every non-obvious requirement and guidance statement in Section 200 should be documented in an endnote of the section in which it appears. Bases are typically LANL, regulatory, or other requirements or drivers. Bases may relate to safety, efficiency, convenience, maintainability, standardization, capacity for future expansion, cost effectiveness, or other reasons. These reasons should not merely be stated, but should be backed up discussion or reference. Cost effectiveness particularly should be backed by a simple cost-benefit calculation where possible. Abbreviations are acceptable when defined by the requirement to which the basis statement refers.

References should include date of publication. Difficult to find references should be additionally numbered with an EMref number available from a log kept on Wolfy server and maintained in standards hardcopy file.

Example:

BASES

SECTION 200

201.2.1 NFPA 70 compliance is required by the WSS. The LANL Electrical AHJ has been designated the NEC code authority by LIR402-600-01, Electrical Safety.
201.2.2 LANL requirement clarifying NEC XXX.XX.
201.2.3 LANL requirement selecting one of several methods allowed by NEC XX.XX to improve safety and maintainability through standardization.
201.2.4 Code requirement repeated verbatim due to its grave safety benefit having been repeatedly being overlooked by designers (ref. Lessons Learned XX-XX, EMref-23).

4.0 NEW/REVISED/DRAFT DOCUMENT REVIEW

This is a website-only section that enables posting of draft documents for review.

5.0 REFERENCES

1. LIR220-03-01, *LANL Engineering Manual*
2. *LANL Engineering Manual, OST220-03-01-EM*
3. *LANL Construction Specifications Manual, OST220-03-01-CSM*
4. *LANL Drafting Manual, OST220-03-01-DM*
5. *Writing Good Requirements (A Requirements Working Group Information Report) by Ivy Hooks, Compliance Automation, Inc., 17629 Camino Real, Suite 207, Houston, Texas 77058; Published in the* Proceedings of the Third International Symposium of the INCOSE - Volume 2, 1993. *Prepared by the Requirements Working Group of the International Council on Systems Engineering, for information purposes only. Not an official position of INCOSE. http://www.incose.org/rwg/*